IN THE CLAIMS

1. (Currently Amended) A method for rapidly controlling the rate of ion generation in an ion source having a filament-cathode and a mirror electrode within walls of a chamber, the filament-cathode and the mirror electrode being opposed along a first direction without intervening structure, the ion source being operable to generate an ion beam from the ionization of an ion precursor gas present in [[a]]the chamber by electrons emitted from the filament-cathode, the method comprising the steps of:

~~supplying current to said~~applying a first potential to a positive end of the filament-cathode, relative to a potential at a negative end of the filament-cathode;

applying a second potential to the walls of the chamber, relative to the potential at the negative end of the filament-cathode;

~~supplying current to said mirror electrode; and~~

controlling the potential ~~difference between said filament-cathode and said~~ of the mirror electrode ~~by modifying the potential of the mirror electrode~~ between the potential at the negative end of the filament-cathode and the second potential, to control the number of electrons available for ionization; and

emitting the ion beam from the chamber in a second direction that is generally perpendicular to the first direction.

2. (Currently Amended) The method of claim 1 ~~further comprising the step of~~wherein the step of controlling comprises reducing an ion beam intensity by driving the potential of the mirror electrode ~~positive relative to the filament-cathode~~toward the second potential.

3. (Currently Amended) The method of claim 1 further comprising the step of increasing an ion beam intensity by driving the potential of the mirror electrode ~~relative to~~toward the potential at the negative end of the filament-cathode.

4. (Previously Presented) The method of claim 1 wherein the filament-cathode is a directly heated filament-cathode.

5. (Previously Presented) The method of claim 1 wherein the filament-cathode is an indirectly heated filament-cathode.

6. (Original) The method of claim 1 further comprising the step of modulating the number of electrons in a manner that varies the ion beam from a first intensity to a second intensity during a time frame of less than one millisecond.

7. (Currently Amended) A method for rapidly controlling the rate of ion generation in an ion source having a filament-cathode[[,]] and a mirror electrode within walls of a chamber, the filament-cathode and the mirror electrode being opposed along a first direction, and at least one grid electrode having an O-shaped grid portion located between the filament-cathode and the mirror electrode along the first direction, the ion source being operable to generate an ion beam from the ionization of an ion precursor gas present in a chamber by electrons emitted from the filament-cathode, the method comprising the steps of:

~~supplying current to said~~applying a potential to the filament-cathode, relative to a potential at a negative end of the filament-cathode;

~~supplying current to~~ connecting said mirror electrode to the potential at the negative end of the filament-cathode;

~~supplying current to the grid, and~~

controlling the ~~potential difference between said filament-cathode and said grid by modifying the~~ potential of the grid electrode positive or negative relative to the filament-cathode to control the number of electrons available for ionization between the grid electrode and the mirror electrode; and

emitting the ion beam from the chamber in a second direction that is generally perpendicular to the first direction.

8. (Currently Amended) The method of claim 7 ~~further comprising~~wherein the step of controlling comprises reducing an ion beam intensity by driving the potential of the grid ~~positive~~electrode negative relative to the filament-cathode.

9. (Currently Amended) The method of claim 7 ~~further comprising~~wherein the step of controlling comprises increasing an ion beam intensity by driving the potential of the grid electrode to ~~negatively bias the grid relative to~~or near the potential of the filament-cathode.

10. (Previously Presented) The method of claim 7 wherein the filament-cathode is a directly heated filament-cathode.

11. (Previously Presented) The method of claim 7 wherein the filament-cathode is an indirectly heated filament-cathode.

12. (Original) The method of claim 7 further comprising the step of modulating the number of electrons in a manner that varies the ion beam from a first intensity to a second intensity during a time frame of less than one millisecond.

13. (Currently Amended) An ~~improved~~ ion source apparatus for rapidly modulating an intensity of an ion beam, comprising:

an ion chamber having mutually opposed ~~sides~~walls that are fixed at a wall potential, one of the walls forming an aperture for emitting the ion beam in a first direction, the chamber ~~and~~ configured to receive an ion precursor gas;

a filament-cathode that is located on one side of said ion chamber, fixed at a filament-cathode potential and operable to emit electrons for ionization of the ion precursor gas for generation of the ion beam; and

a mirror electrode having a potential associated therewith and located on the other side of said ion chamber in a second direction relative to the filament-cathode, the second direction being approximately perpendicular to the

first direction, said mirror electrode being connected to a circuit to vary its potential relative to said wall potential and the filament-cathode potential so as to vary the number of the electrons available in the ion chamber for ionization.

14. (Previously Presented) The apparatus of claim 13 wherein said mirror electrode is operable for modulating the ion beam from a first intensity to a second intensity during a time frame of less than 1 millisecond.

15. (Previously Presented) The apparatus of claim 13 wherein the filament-cathode is a directly heated filament-cathode.

16. (Previously Presented) The apparatus of claim 13 wherein the filament-cathode is an indirectly heated filament-cathode.

17. (Currently Amended) An ~~improved~~ ion source apparatus for rapidly modulating an intensity of an ion beam, comprising:

an ion chamber having mutually opposed ~~sides~~walls that are fixed at a wall potential, one of the walls forming an aperture for emitting the ion beam in a first direction, the chamber ~~and~~ configured to receive an ion precursor gas;

a filament-cathode that is located on one side of said ion chamber, fixed at a filament potential and operable to emit electrons for ionization of the ion precursor gas for generation of the ion beam;

a mirror electrode located on the other side of said ion chamber in a second direction relative to the filament-cathode, the second direction being approximately perpendicular to the first direction, and

at least one grid electrode extending inside said ion chamber and positioned between said filament-cathode and said mirror electrode along the second direction, said at least one grid electrode being connected to a circuit

operable to vary ~~its~~ a potential of the grid electrode positive or negative relative to said filament-cathode ~~and being operable~~ so as to vary the number of electrons available in the ion chamber for ionization.

18. (Previously Presented) The apparatus of claim 17 wherein the filament-cathode is a directly heated filament-cathode.

19. (Previously Presented) The apparatus of claim 17 wherein the filament-cathode is an indirectly heated filament-cathode.

20. (Currently Amended) The apparatus of claim 17 wherein said at least one grid electrode is positioned in proximity to said filament-cathode so as to vary the number of electrons available for ionization between said at least one grid electrode and said mirror electrode.

21. (New) The apparatus of claim 17 wherein the grid electrode includes an O-shaped grid portion.

22. (New) In a Bernas-type ion source having a filament-cathode and a mirror electrode disposed along a first direction within a chamber, the ion source being operable to generate an ion beam from the ionization of an ion precursor gas in the chamber by electrons emitted from the filament-cathode, the chamber having walls, one wall forming an aperture to allow emission of the ion beam from the chamber in a second direction that is generally perpendicular to the first direction, an improvement comprising:

a mirror electrode programming circuit for controlling a potential of the mirror electrode between a potential of the filament-cathode and a potential of the walls.

23. (New) In a Bernas-type ion source having a filament-cathode and a mirror electrode disposed along a first direction within a chamber, the ion source being operable to generate an ion beam from the ionization of an ion precursor gas in the chamber by

electrons emitted from the filament-cathode, the chamber having walls, one wall forming an aperture to allow emission of the ion beam from the chamber in a second direction that is generally perpendicular to the first direction, an improvement comprising:

at least one grid electrode located between said filament-cathode and said mirror electrode along the second direction; and

a grid programming circuit for controlling a potential of the grid electrode positive or negative relative to a potential of the filament-cathode.

24. (New) Ion source of claim 23, wherein the grid electrode includes an O-shaped grid portion.

25. (New) Ion source of claim 23, wherein the grid electrode is located in relative proximity to the filament-cathode.

26. (New) Ion source of claim 23, wherein the grid electrode includes a plurality of grids.